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Bescheinigung

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Patentanmeldung Nr. Patent application No. Demande de brevet n°

99201223.7

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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I.L.C. HATTEN-HECKMAN

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THE HAGUE, 16/03/00
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**Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation**

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ASM LITHOGRAPHY B.V.
5503 LA Veldhoven
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SPEC

Exposure apparatus.

5 The invention relates to an exposure apparatus with a light source, an illumination module, a reticle handler, a projection module, and a substrate handler.

Such an exposure apparatus is used for lithographic device manufacturing, in particular lithographic semiconductor manufacturing. The exposure apparatus is usually embodied as either a step and repeat system or a step and scan system, also referred to as
10 a stepper and a scanner, respectively.

During exposure operation a reticle chuck of the reticle handler contains a reticle and a substrate chuck of the substrate handler positions a substrate; the reticle and the substrate are also referred to as a mask and a wafer, respectively. Then the light source exposes through the illumination module a pattern of the reticle, which pattern is projected through the
15 projection module on a part of the wafer.

Frequently, the substrate chuck must be loaded with a to-be-exposed wafer, whereby an exposed wafer must be unloaded. To provided for high throughput of the exposure apparatus, the invention aims to provide a substrate handler, which enables short load and unload periods.

20 The substrate handler in accordance with the invention is therefor equipped and can be characterized in that the substrate handler comprises a pre-alignment station, a load robot, an unload robot, and a discharge station, whereby the load robot is capable to transfer a wafer from the pre-alignment station to a substrate chuck, and whereby the unload robot is capable to transfer the wafer from the substrate chuck to the discharge station.

25 Hereby the wafer can be transferred to and from the substrate handler, hereinafter the wafer handler, by means of either a wafer carrier or a process track. The wafer carrier is a separate box that is put on the wafer handler, to provide one or more wafers or to obtain one or more wafers; the process track is a separate system that automatically and continuously provides or obtains wafers; throughput benefits from a direct track interface, which puts wafers directly
30 onto the pre-alignment station.

In Figure 1 a substrate handler of an exposure apparatus in accordance with the invention is shown, which substrate handler is in a neutral unloaded position,

In Figure 2a a substrate handler of an exposure apparatus in accordance with the invention is shown, which substrate handler is in a first loaded position, and

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in Figure 2b a substrate handler of an exposure apparatus in accordance with the invention is shown, which substrate handler is in a second loaded position.

With reference to Figure 1, relevant functional parts of the wafer handler 1 are now described in more detail.

5 After a wafer has been transferred from a wafer carrier or a process track (not shown), the pre-alignment station 2 starts pre-alignment, for example by wafer edge measurement. The wafer is rotated on a central rotational drive unit 21, while backside clamping the wafer. Wafer edge measurement can be achieved with well-known modules, such as an edge sensor module 22 using an optical system with a light source and a light-
10 sensitive element, which source and element are positioned on opposite sides of the wafer. Transfer means of the edge sensor module arrange for centering of the wafer, if not accurately positioned from the wafer carrier or the process track. Contact areas between such transfer means and the wafer have are minimized. Finally, absolute position of the wafer is measured. The pre-alignment station also arranges for temperature conditioning of
15 the wafer, which is done in parallel with pre-alignment, to benefit throughput. A non-contact device, based on air-bearing techniques, arranges for such temperature conditioning, to reduce wafer backside contamination. Such air-bearing techniques also enable a reduced wafer bow and warp during wafer edge measurement, to obtain more accurate edge measurement, and a more clean wafer backside, when blowing ionized air to remove
20 particles collected on the wafer backside.

Then the load robot 3 transfers the wafer to the substrate chuck (not shown). The load robot is equipped with an independent and separate trajectory safeguard system, in order to avoid wafer breakage. During operation of the load robot, measured absolute position (edge sensor module) and derived velocity are compared with a permitted position and
25 velocity: absolute position of the wafer is known very accurately when the wafer is taken from the pre-alignment station, and actual position of the wafer is known very accurately when the wafer is put on the substrate chuck. A docking unit 31 on the load robot reassures position accuracy, which docking unit is of a ball/groove cinematic coupling type. Respective ball is located in the load robot; mentioned groove is present on both the pre-alignment station and
30 the substrate chuck. To enable accurate wafer transfer, docking is also done on two positions. For safety reasons, rotating part of the load robot is equipped with a light-shield, blocking any stray light from the substrate chuck to the wafer carrier or the process track.

After full exposure, the unload robot 4 transfers the wafer from the substrate chuck to the discharge station 5, which unload robot is equipped similarly to the load robot. Then the

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wafer is transferred from the discharge station, also referred to as a pedestal, to the wafer carrier or the process track.

The wafer handler 1 may further be provided with a carrier handler 6, which enables use of different types of wafer carriers, such as 200mm and 300mm cassette carriers. The carrier handler can be configured on either left or right side of the exposure equipment and
5 arranges for accepting and (if applicable) locking a wafer carrier, inspecting and indexing a wafer carrier, and (if applicable) opening and removing a wafer carrier.

Inspecting, which arranges for position determination, may be done by means of an optical system: wafer edge reflection of light, consisting of parallel light rays, is detected.

10 In Figure 2a a substrate handler in a first loaded position is shown. Herein the pre-alignment station 2 contains a wafer 71, which has been pre-aligned and conditioned, while the load robot 3 is already positioned to transfer the wafer, after half-rotation of the load robot, to the substrate chuck. Simultaneously the unload robot 4 contains a wafer 72, which has been removed from the substrate chuck and which, after half-rotation of the unload
15 robot, will be transferred to the discharge station 5.

In Figure 2b a substrate handler in a second loaded position is shown. Herein the load robot 3 the wafer 71, which is transferred to the substrate chuck. The unload robot 4 still contains the wafer 72, for transfer to the discharge station 5.

20 Above description gives only limited detail, although the invention involves complex means and processes. The invention should therefore be seen and understood in broader perspective, comprising any means and processes, which a skilled man would read therein.

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Claim:

- 5 1. An exposure apparatus with a light source, an illumination module, a reticle handler, a projection module, and a substrate handler (1), is characterized in that the substrate handler (1) comprises a pre-alignment station (2), a load robot (3), an unload robot (4), and a discharge station (5), whereby the load robot (3) is capable to transfer a wafer from the pre-alignment station (2) to an substrate chuck, and whereby the unload robot (4) is capable
- 10 to transfer the wafer from the substrate chuck to the discharge station (5).

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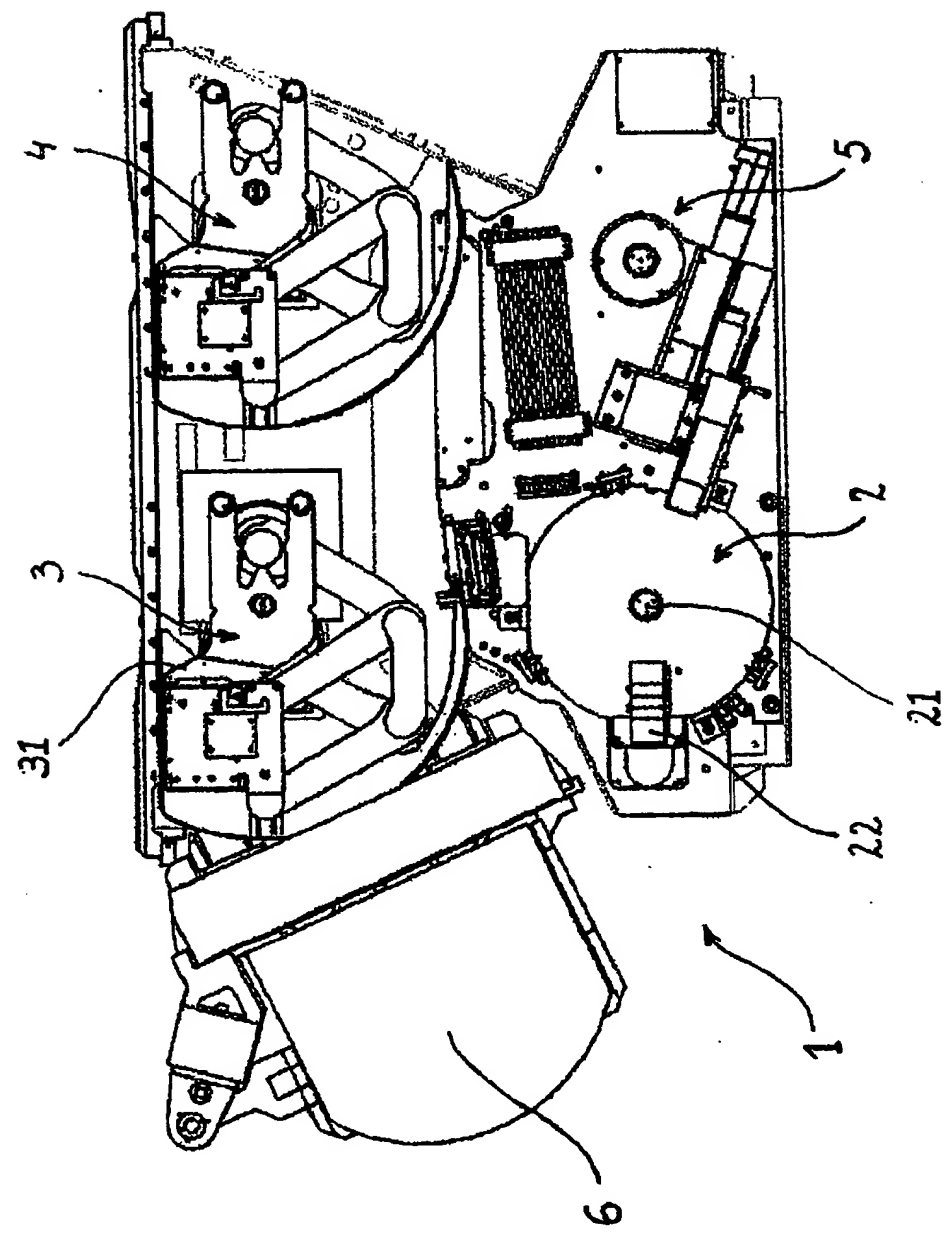
Abstract:

5 **Exposure apparatus.**

The invention relates to an exposure apparatus with a light source, an illumination module, a reticle handler, a projection module, and a substrate handler (1), wherein the substrate handler (1) comprises a pre-alignment station (2), a load robot (3), an unload
10 robot (4), and a discharge station (5), whereby the load robot (3) is capable to transfer a wafer from the pre-alignment station (2) to an substrate chuck, and whereby the unload robot (4) is capable to transfer the wafer from the substrate chuck to the discharge station (5).

15 (Fig. 1).

Fig. 1



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Fig. 2a

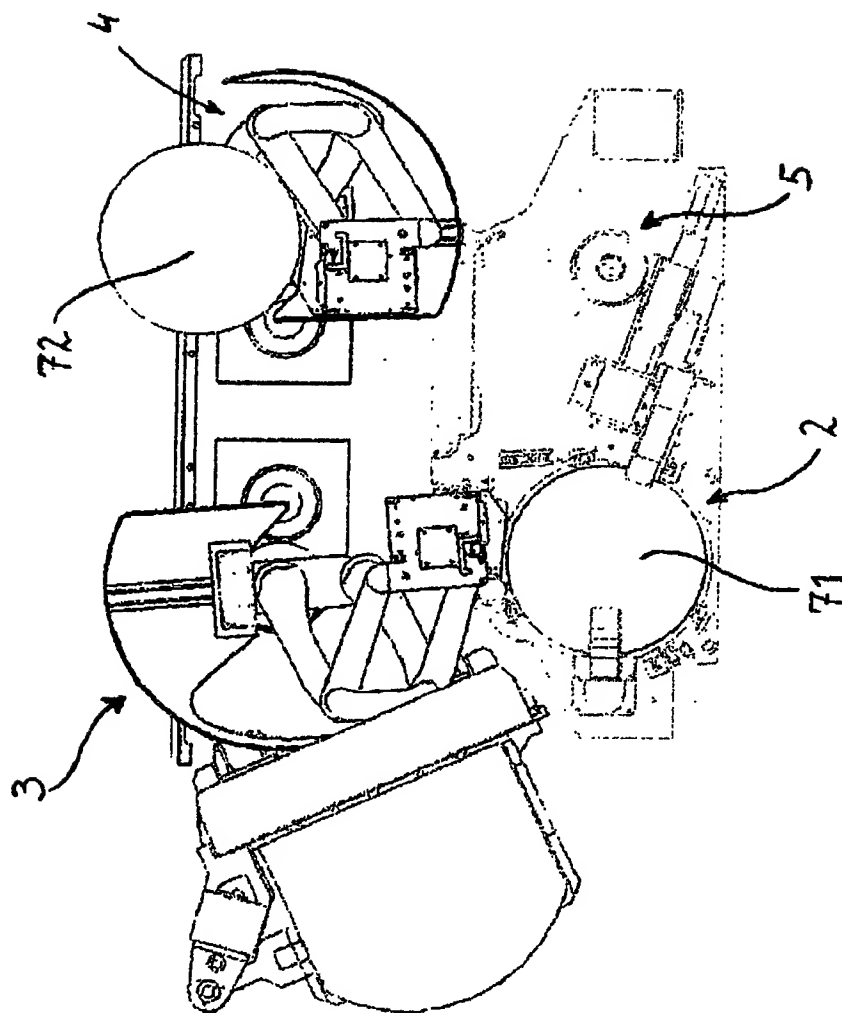


Fig. 2b

